PUBLIC HEALTH REPORTS.

VOL. XXVI. NOVEMBER 17, 1911. No. 46

THE CHOLERA SITUATION.

Reports received indicate that the outbreak of cholera in the northern part of Italy has about subsided, and that fewer cases are being reported in the rest of Italy. Otherwise there has been no material change in the cholera situation during the past week.

AN INVESTIGATION OF THE PREVALENCE OF TYPHOID FEVER AT CHARLES TOWN, W. VA.

By J. R. RIDLON, Assistant Surgeon, Public Health and Marine-Hospital Service.

Upon request of the State board of health to the Surgeon General, Public Health and Marine-Hospital Service, to send an officer for the purpose, the writer was detailed to conduct investigations of typhoid fever in Charles Town, W. Va., and vicinity, to determine the cause of the undue prevalence of the disease, the methods of transmission, and the measures necessary for its control. The investigation extended from August 19 to September 13, 1911.

It is a pleasure to make due acknowledgment of the help and courtesies afforded by the board of health, the mayor and city council, the local newspapers, the officials of the water company, and various other citizens of the city. Appreciation is expressed for the cooperation of the local physicians, without which assistance a complete investigation would have been impossible.

A temporary laboratory, supplied from the Hygienic Laboratory, was established in Charles Town at the office of Dr. C. L. Skinner, for whose courtesy appreciation is also expressed.

POSSIBLE CAUSES.

A preliminary survey of the situation showed that the possible causes to be considered were much the same as in other localities at this season of the year, namely, (1) water supply; (2) milk supply; (3) ice supply; (4) uncooked fruits and vegetables; (5) other food supplies, including ice cream, shellfish, and bakery products; (6) infection by personal contact; (7) infection by flies; and (8) infection through faulty disposal of excreta.

SCOPE OF INVESTIGATIONS.

The investigation included (1) a sanitary survey of the source of the town water system; (2) a study of general sanitary conditions in the city, including the milk supply, the food supply, and the disposal of sewage; (3) a bacteriological examination of the town and other waters; (4) the making of Widal tests as an aid in diagnosis; and (5) an epidemiological study of 30 cases occurring since the 1st of June. For the latter a blank form was used and filled out with information furnished by the patient or other reliable person and covering all facts pertinent to the possible source of infection.

EXTENT OF OCCURRENCE OF TYPHOID.

Among a population of 4,000 (estimated), including the cities of Charles Town and Ranson and the people within a radius of about 3 miles, there occurred during June, July, and August, 1911, 30 cases of typhoid fever with 2 deaths.

Ranson may be classed practically as a part of Charles Town, although under a separate city government. It is really an extension of the city and has the same public water supply. Many people living in Charles Town are employed in Ranson and vice versa. The population is estimated at between 500 to 600 and the houses are, for the most part, more widely scattered than in Charles Town. Ranson appears to have been remarkably free from typhoid, no cases having been reported in that community.

The above reports of cases and deaths are taken from personal reports by the physicians, as typhoid fever is not reported officially. The record of deaths is incomplete and unsatisfactory, so that no accurate comparison can be drawn between this year and previous ones. This condition should be remedied by the reporting of cases of typhoid fever to the health officer, as are certain other infectious diseases.

The above figures give a rate of occurrence equal to 1 case of typhoid to every 133 people, and a mortality rate of 50 deaths to 100,000 of population, which rate may be justly considered excessive, regarding typhoid fever as a preventable disease and not a necessary evil. The case mortality rate, being 6.6 per 100, is lower than the average, which is usually regarded as 10.

The general opinion of physicians and others is that there has probably been little, if any, more typhoid fever in Charles Town and vicinity during the present season than for preceding years.

The distribution of the cases between the city and surrounding country shows that in proportion to the population the incidence of the disease is about equal, 22 cases having occurred in the city in a population of 3,000 and 8 in the country in a population of about 1,000. The 30 cases occurred in the following months: 2 in June, 11 in July, and 17 in August. This closely follows the usual seasonal prevalence of the disease, the greater number of cases usually appearing in August and September except in epidemics of an explosive and widespread character, such as may be caused by water or milk borne infection, and frequently appear in the colder months. A tendency to the grouping of cases is shown by a study of their location. Seven occurred in one neighborhood on South George

Street, 2 occurred in a hotel and 2 in the immediate vicinity, 4 occurred on the same farm, 3 in one neighborhood in the southwestern part of the city, 2 near Conrad Spring, 2 in the same house on Washington Street, while only 8 were scattered or isolated cases. Of the 30 cases 12 occurred in 4 houses, distributed as follows: 5 in 1 house, 3 in another, 2 in another, and 2 in still another. These facts suggest that contact and flies were important factors in the spread of infection.

AGE.

The distribution according to age was, under 5 years, 2; 5 to 9 years, 7; 10 to 14 years, 6; 15 to 19 years, 6; 20 to 24 years, 0; 25 to 29 years, 3; 30 to 34 years, 1; 35 to 39 years, 2; 40 to 44 years, 0; 45 to 49 years, 3; total, 30.

The occurrence of 15 cases, or 50 per cent, among children under 15 years of age is a high percentage.

SEX.

The distribution of the cases was nearly equal according to sex, 16 being among males and 14 among females.

COLOR.

Twenty-two cases occurred among the white population and 8 among the colored. Of these 8 cases 4 were probably contact cases, occurring where little, if any, attention was given to sanitary surroundings.

WIDAL TESTS.

As an aid in diagnosis 11 Widal agglutination tests were made of which 5 were positive for *Bacillus typhosus*, 2 positive for *Bacillus paratyphosus A*, and 4 negative. Of the 4 negative ones 2 cases were not clinically typhoid, and 2 cases in which the test was made during the first week were clinically typhoid and are so classed.

It is interesting to note that paratyphoid infection was present along with the typhoid infection, 2 cases showing positive agglutination for *Bacillus paratyphosus A*, but not for *Bacillus typhosus*. It is regretted that the paratyphoid organism was not isolated.

It is extremely improbable that any errors of diagnosis were made in the 30 reported cases.

DISCUSSION OF EPIDEMIOLOGY.

MILK.

Of the 30 cases 22 gave a history of using raw milk within 30 days of onset of the disease. Eight of these used milk from their own cows. In one instance a boy, during the incubation period, was carrying milk to several customers, and in two instances milk was being supplied from a place where there was a typhoid patient.

The most probable source of infection for one case was from milk. Taking into account the age of the patients, 50 per cent being under

15 years, and the irregular source of supply in several instances, it is probable that milk was a more important factor in the spread of infection.

A number of patients gave a history of obtaining milk within 30 days from several sources, some of which they could not remember, and this irregularity of supply necessarily made the source of infection much more difficult to trace.

The fact that no license is required to sell milk and that no sanitary supervision is exercised over the sources of supply must be regarded as dangerous to the public health, not only in regard to the spread of typhoid fever, but of other infectious diseases as well.

Much of the milk used in the city comes from places where only a few cows are kept and the surplus beyond home consumption is sold. In but few cases could the sterilization of milk receptacles be called adequate, and pasteurized milk is not sold.

ICE CREAM.

Of the 30 patients, 19 used ice cream occasionally within 30 days at various places, mostly at home. No suspicion was attached to any common supply, and ice cream can be practically eliminated as a source of infection.

UNCOOKED FOODS.

At this season in Charles Town uncooked shellfish can be definitely eliminated.

The use of uncooked fruits and vegetables was quite general among the 30 patients, the supply being obtained from various sources, but no case could be definitely attributed to either of these causes. However, the exposure of these articles, in the markets and elsewhere, to contamination by flies and dust is to be regarded as a possible source.

ICE.

The general use of artificial ice made from distilled water makes it possible to practically eliminate this as a possible factor.

FLIES.

The most probable source of infection in 5 cases was from flies. These cases were located within 200 feet or less of other cases where the disinfection of stools was inefficient, where there were no screens, and where the abundant flies had free access to both dejecta of patients and the food. That flies under the proper conditions can be a prominent factor in the spread of infection is an undisputed fact, as is also the fact that their prevalence can be greatly limited by proper care of their breeding places, including stable manure, household refuse, and garbage.

CONTACT.

The most probable source of infection in 10 cases, or 33⅓ per cent, was from contact. These patients gave a history of living in the same house in intimate association with other patients, either in the febrile or incubation stage of the disease. This is a high percentage and shows that contact becomes a most important factor where the necessary precautions are not taken.

SANITARY CONDITIONS.

The sanitary conditions of the premises where the 30 cases occurred were as follows: Good in 6, fair in 7, and bad in 17 instances. This rating is based upon consideration of sewage, the presence of flies, the presence of screens, the disposal of garbage about the yard, etc.

Charles Town has no general sewerage system, but relies upon the use of privies, water-closets, and cesspools. Some of these cesspools are shallow and drain away slowly from the bottom, while others have a communication with a fissure in the limestone and drain rapidly.

Taking the community as a whole, the prevalence of the open privy, aggravated in certain instances by its contents being spread over the premises by fowls, by the surface soil pollution resulting from seepage, and by the ready access of flies, must be regarded as a menace to the public health. These conditions affect not only the occupants of the premises, but neighbors who live in better sanitary surroundings.

Another considerable source of soil pollution is furnished by the shallow cesspools, and underground water is polluted by deeper cesspools draining into streams of water in the crevices and caverns of limestone formation.

Concerning the disinfection and disposal of the excreta of typhoid patients in regard to the possible spread of infection, it was found that this was carried out in an efficient manner in 10 instances, fairly efficient in 12 instances, and not efficient in 8 instances. This was brought about by lack of care or disregard in following out physicians' instructions.

PUBLIC WATER SUPPLY.

The public water supply has been obtained from three sources, a large covered spring within a mile of the city, a smaller spring near the Golloday house, and the mill race part of the time.

The water from the large spring flows through an iron pipe to the mixing tank. The water from the smaller spring flows in a stream about a quarter of a mile through swampy land to an intake in a terra-cotta pipe and thence to the mixing tank. This stream receives a certain amount of seepage in its passage through the swamp, and at times has received a stream of water flowing from the so-called mill race which runs near by. The mill race is a small stream rising several miles beyond and flows through farm land and near several houses from which it can receive drainage. From the mixing tank the water flows through three receiving tanks and is pumped to two standpipes, from which it is distributed.

The amount of water used is estimated at about 200,000 to 220,000 gallons daily, and it is used by a very considerable proportion of the citizens of the city either as a regular or occasional supply.

The amount furnished by the large spring is estimated at about one-quarter of the total supply and is entirely inadequate for the needs of the city.

A sanitary survey of the area drained by the small spring and by the mill race shows that both of these waters are subject to a gross amount of pollution, both from human and animal sources. A house with outbuildings is situated within 150 to 200 feet of the smaller

spring and on higher ground, so that at least part of the drainage is toward the spring. After a rain it is possible for an enormous amount of sewage pollution to be washed into these waters. This does not apply to the water of the large covered spring, which is of good sanitary quality and is only remotely subject to contamination from human excreta deposited from passing railroad trains.

The bacteriological examinations of the public water supply show that it is contaminated to a degree highly dangerous to the consumers when used for household purposes. Samples from various parts of the system show the presence of the colon bacillus in 0.1 cubic centimeter at repeated examinations. This applies to samples taken from the small spring (Golloday), from the mill race, from the terra cotta intake, from the receiving tanks and tap water, but not to samples taken from the large covered spring.

Taking the colon bacillus as an index of sewage pollution, its consistent presence in such small amounts as 0.1 cubic centimeter is to be regarded as indicating a high degree of pollution.

In all, 48 bacteriological examinations of water samples were made, taken from the public supply, wells, and springs. Fermentation tests were made in lactose bouillon incubated at 37° C. for 48 hours. Plates of standard agar, acid 1+ to phenolphthalein, and kept at room temperature for 48 hours were used in making the counts. There were no facilities for using gelatin. By this method much lower counts were obtained than had gelatin been used. The tube showing fermentation in the least amount from each sample was used for plating out on Endo's medium. From this medium typical red colonies of *B. coli* were fished and later fully identified at the Hygienic Laboratory.

Results of examinations of the public supply.

LARGE SPRING (COVERED).

Date.	Number of bacteria per c. c.	Fermentation in lactose bouillon.			B. coli in—		
		10 c. c.	1 c. c.	0.1 c. c.	10 c. c.	1 c. c.	0.1 c. c.
1911.							
Aug. 21	176	−	−	−	−	−	−
Aug. 26	20	−	−	−	−	−	−
Aug. 31 [1]	16,660	+	+	+	+	+	+
Sept. 2 [1]	1,660	+	+	−	+	+	−
Sept. 5	430	+	−	−	−	−	−
Average	3,790						

UPPER SPRING (GOLLODAY).

Aug. 21	2,530	+	+	+	+	+	+
Aug. 26	12,000	+	+	+	+	+	+
Sept. 2	3,000	+	+	+	−	−	−
Sept. 5	6,000	+	+	+	−	−	−
Average	5,880						

[1] The presence of colon bacilli on Aug. 31 and Sept. 2 is accounted for by the fact that after heavy rains surface water flowed into the spring house through the overflow pipe. These examinations also raise considerably the average number of bacteria.

Results of examinations of the public supplg—Continued.

MILL RACE.

Date.	Number of bacteria per c. c.	Fermentation in lactose bouillon.			B. coli in—		
		10 c. c.	1 c. c.	0.1 c. c.	10 c. c.	1 c. c.	0.1 c. c.
Aug. 26	14,000	+	+	+	+	+	+
Aug. 28	12,000	+	+	+	+	+	+
Average	13,000						

TERRA COTTA INTAKE.

Aug. 21	306	+	+	+	+	+	+
Aug. 26	10,000	+	+	+	+	+	+
Sept. 5	4,930	+	+	+	+	+	+
Average	5,078						

MIXING TANK ABOVE RECEIVING TANK.

Aug. 21	1,900	+	+	+	+	+	+

RECEIVING TANK NO. 3.

Aug. 21	1,170	+	+	+	+	+	+
Aug. 26	9,400	+	+	+	+	+	+
Aug. 31	24,000	+	+	+	+	+	+
Sept. 2	2,460	+	+	+	+	+	+
Sept. 5	4,000	+	+	+	+	+	+
Average	8,206						

TAP WATER.

Aug. 28	8,660	+	+	+	+	+	+
Aug. 31	8,660	+	+	+	+	+	+
Sept. 2	2,400	+	+	+	+	+	+
Sept. 5	6,000	+	+	+	+	+	+
Average	6,430						

The histories of the 30 patients in regard to water supply was as follows:

Kind of water used.	Solely.	Principally.	Occasionally.
Raw tap water	8	6	6
Boiled tap water		1	2
Public wells, shallow		1	2
Spring water	1	2	4
Cistern water	1	7	1
Deep wells	1	2	1

In regard to the question as to what part the public water supply has played in the causation of typhoid in Charles Town during the present season, evidence is lacking that it has played any considerable part. This assertion is based upon the following facts:

1. The occurrence of typhoid has not been in the nature of an explosive outbreak, where large numbers of people were affected by

the same cause at about the same time, as is usually seen in water-borne epidemics.

2. No cause of typhoid has been reported on the watershed of the public supply during the present season.

3. The cases have shown a marked tendency to group themselves in certain localities, suggesting a local source of infection spread by contact and flies.

4. Of the eight patients giving a history of using raw tap water solely, the most probable source of infection in four instances was from contact with other patients. Of the six patients giving a history of using raw tap water principally, the most probable source of infection was from contact in four cases and from flies in one case.

5. No case has been reported as occurring in Ranson, which is remarkable in view of the number of people in that city using the public supply.

6. In proportion to population, typhoid has been as prevalent in the country as among the residents of Charles Town using the public supply.

The conclusion is justified that the public supply has played but little and, if any, a very transitory part in the causation of typhoid in Charles Town during the present season, but that it is to be considered as a supply dangerous to the public health from its evident pollution and from the possibility of a water-borne epidemic occurring at any time should a case of typhoid occur near the source of supply.

PUBLIC WELLS.

Bacteriological examination was made of the water from four public wells (shallow), namely, the Hull well, the Tomlinson well, Potato Hill well, and Depot well. These all show evidences of pollution, as was to be expected from the soil pollution in their vicinity. Samples of 0.1 cubic centimeter from each well have shown the presence of colon bacillus at some time.

These waters are not to be considered safe for household uses. However, evidence is lacking that typhoid fever has been caused by their use.

Summary of examinations of well waters.

Source of sample and date taken.	Number of bacteria per c. c.	Fermentation in lactose bouillon.			B. coli in—		
		10 c. c.	1 c. c.	0.1 c. c.	10 c. c.	1 c. c.	0.1 c. c.
Tomlinson well:							
Aug. 26	11,000	+	−	−	+	−	−
Sept. 2	4,060	+	+	+	+	+	+
Sept. 5	2,060	+	+	+	+	+	+
Depot well:							
Aug. 22	310	+	+	−	−	−	−
Aug. 28	1,400	+	+	+	+	+	+
Hull well:							
Aug. 22	2,100	+	+	+	+	+	+
Aug. 26	(1)	.....	−	−	.....	−	−
Aug. 31	785	+	+	+	−	−	−
Sept. 11	8,000	+	−	−	+	−	−
Potato Hill well: Aug. 31	14,500	+	+	+	+	+	+

[1] Not plated.

SPRINGS.

The most probable source of infection in two instances was attributed to the use of water from the so-called Conrad Spring, no other origin being apparent. An examination of this water showed it to be polluted.

SUMMARY.

There was an excessive rate of typhoid fever in Charles Town and vicinity during June, July, and August, 1911. An analysis of the histories of the cases points to several probable sources of infection. In 10 cases the most probable source of infection was from contact with other patients in the febrile stage of the disease.

In 5 cases the most probable source of infection was from flies, these cases being located in the vicinity of other patients where proper precautions were not always taken.

Although only one case was attributed to milk, it is probable, taking into account the age of the patients and the lack of supervision over the milk supply, that milk played a more important part as the cause of sickness.

Evidence is lacking that the public water supply has played more than a minor part in the causation of typhoid.

As is usual in any series of cases, in several instances no one cause can be decided upon as the most probable. This is due to the varied conditions under which people mingle in their business and social relations and to the varied sources of supply of water and food.

RECOMMENDATIONS.

For the prevention of typhoid fever in Charles Town:

1. Improvement of water supply.
2. Improvement of the method of sewage disposal.
3. Supervision over the milk supply and food supply, and attention given to the disposal of stable and household refuse.
4. More careful attention to disinfection in the cases of typhoid fever.

WATER.

The supply should be free from sewage pollution, abundant, and of a chemical nature suitable for mechanical uses and free from objectionable tastes and odors.

The possible sources are mountain springs and streams, near-by springs, deep wells, and the present supply after proper purification by filtration.

Whatever course is adopted, it is advisable first to consult competent engineers and to have made careful bacteriological and chemical examinations of the water before use.

There are said to be no mountain springs or streams available on the Blue Ridge. If found available, their use would depend upon the rather heavy initial expense in piping and protection of the watershed.

It is extremely improbable that any near-by springs can be found which combine the necessary quantity with satisfactory sanitary qualities.

Deep wells in limestone, with its crevices and cavernous formation which afford little opportunity for self-purification of the water, can

not be regarded as the best kind of deep wells from a sanitary standpoint. The quantity obtained from one or a series of deep wells would probably be sufficient. In case wells are sunk their location would be very important, to avoid any possibility of contamination from the deep cesspools in the city. Every indication points to the best location as being in the northwest direction from the city, the general dip of the strata being from that direction. To avoid any possible pollution the wells would have to be located well beyond the city limits. Wells so placed would have to be of sufficient depth and carefully cased to exclude all water from near the surface. These points can be determined only by experimentation and by careful bacteriological examination of the water so obtained. On the whole, this seems to be the most feasible source of supply, but has its drawbacks in its uncertainty.

In case the present source of supply only shall be found available it will be necessary to use purification processes of the highest degree of efficiency. Mechanical filtration of such a small amount of water can not be used on the most economical basis.

The water containing, as it does, at least one colon bacillus in 0.1 cubic centimeter, contains at least 100 in 10 cubic centimeters. Granting an efficiency of 99 per cent in the removal of bacteria by filtration, the effluent would contain at least one colon bacillus in 10 cubic centimeters in a large percentage of samples and could not be regarded as of the best sanitary quality.

The following is offered for consideration in regard to the purification of the water:

1. The use of the mechanical or rapid filtration method, the amount, and the best coagulant to be determined by experimentation.
2. The use of hypochlorite of lime on the effluent after filtration.

It is advised that hypochlorite of lime be used on the water as a temporary expedient and that in the meantime repeated warnings be given to the people to boil all water used for drinking and household uses.

In regard to the shallow wells, it is advised that their use be discontinued as soon as a pure public supply shall have been obtained; that in the meantime all known sources of pollution in their vicinity be removed, and that their linings be overhauled and their platforms made tight.

SEWAGE DISPOSAL.

It is recommended that careful consideration be given by the citizens of the community to the establishment of a closed sewerage system over the whole city, with a proper sewage-disposal plant.

In the meantime soil pollution should be limited by the abandonment of all open privies and the substitution therefor of privies of a sanitary type provided with a galvanized iron or wooden tub on a raised platform, the contents to be disinfected with chloride of lime or carbolic acid, and emptied and buried at frequent intervals. This privy should be protected from flies by tight joints and by screening of windows or air vents.

Cesspools should be abandoned or made water-tight and frequently disinfected by a solution of chloride of lime, especially those which are known to have received the dejecta of typhoid patients.

The municipal authorities, through the board of health, should have control over the proper care of cesspools and privies.

SUPERVISION OF FOOD AND SUPPLIES.

The sale of milk should be under the supervision of the city authorities, those desiring to sell milk taking out a license and being subject to inspection. The sale of milk should be prohibited when coming from insanitary premises or from places where patients suffering from typhoid or other infectious diseases are under treatment if there is the least possibility of contamination.

The prevalence of flies should be limited by attention being given to their breeding places, which are chiefly in stable and household refuse. The disposal of these wastes should be under control of the city authorities. Proper screening of the receptacles for these wastes or disinfection and frequent removal should be required.

TYPHOID PATIENTS.

These should be reported to the board of health and proper instructions given and carried out in regard to the disinfection of dejecta and the screening of rooms. In cases when necessary chloride of lime or other disinfectant should be distributed free of charge.

It is evident that in the carrying out of these provisions the board of health will consume a certain amount of time and money, and the city should take more fully into account the importance of its health organization and provide adequately for it.

For the prevention of typhoid these other precautions are to be considered as of nearly if not quite equal importance to the obtaining of a pure water supply, and their cost is relatively very much less. These precautions being neglected, even after a pure water supply is obtained, typhoid is reasonably certain to prevail as an endemic disease.